ETHNOBOTANY AND PHYTOCHEMISTRY OF MEDICINAL PLANTS OF CHUHAR VALLEY OF HIMACHAL PRADESH, INDIA

SYNOPSIS

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INTRODUCTION

Ethnobotany is the study of correlation between people and plants. It is the universal approach which requires interaction of indigenous people with plants. The main focus of ethnobotany is to indicate that how plants have been used and identified in human societies (Schutles, 1962; Ford, 1980). Harshberger (1895) coined the term ethnobotany which includes varieties of plants useful for medicines, dyes, food and tannins. The importance and applications of ethnobotany have been growing at a rapid rate (Jain, 1995). Plants are the main source for medicinal formulations. In whole world, total 4, 22,000 flowering plants are reported, out of which more than 50,000 are used for medicinal applications. It has been estimated that more than 43% of the total flowering plants in India have been reported for medicinal uses. A medicinal plant contains effective constituents which can be used for preparation of useful drugs (Badola and Pal, 2002).

Himachal Pradesh is a hilly region and has rich plant biodiversity. The North Western Himalaya is having varying degree of agro climatic conditions which is ranging from subtropical to extreme cold. The Himalayan region is a bucket of expansive range of medicinal herbs and flora. In Himachal Pradesh, there are about 3500 known plant species recorded so far, out of which 500 are reported on the medicinal importance (Chauhan, 2003). It has been estimated that around 65,000 species of medicinal plants are used in Asia alone for various diseases (Karki et al., 1999). World Health Organization (WHO) also described that about 80 percent of the world's population depend upon conventional systems of medicinal formulations for their primary health care requirements. Although, medicinal plants play important role in world's economy as numerous modern medicines are derived from plants. The medicinal plant based industry is growing day by day, where India's share in global market is not much magnificent (only 0.5 to 1%), while requirement for these medicinal plant based products is increasing at very fast rate. In India, The tribal and rural population still relies mostly on the local herbs and medicinal flora for curing different types of ailments (Singh and Thakur, 2014). It has been reported that 1748 species of vascular plants are used for medicinal purposes, whereas 816 species of plants are used as trees and 279 species as fodder (Samant et al., 2007). Samant and Dhar (1997) also explained about 675 species of medicinal plants which are used as wild edibles. While 118 species are reported as essential oil yielding medicinal plants (Samant and Palni, 2000) and 155 species as holy plants (Samant and

Shreekar, 2003). Himachal Pradesh is one of most interesting reservoirs of medicinal flora in the North Western Himalaya due to high species richness and diverse community structure (Aswal and Mehrotra, 1994). In Himachal Pradesh, approximately 66.45% of geographical area is covered with natural vegetation and forests. Bhardwaj and Seth (2017) described that Himachal Pradesh becomes a distinct Himalayan territory due to its various characteristic related to climate, geology and floristic (manifested through different phytoclimatic and topographic regimes).

The Mandi district of Himachal Pradesh is known for its rich biodiversity and abundant medicinal plant hot spot in North Western Himalaya, which has largest areas of traditional and prospective medicinal wealth (Dhaliwal and Sharma, 1999). The vegetation and medicinal flora of the Mandi district comprises of sub-tropical, temperate, sub-alpine and alpine types, and also supports a large number of medicinal, wild edibles, rare-endangered and wild crop plants. The local residents relies on the fascinating biodiversity for medicine, agricultural tools, fiber, religious, aromatic plants, wild edibles, fuel, fodder, timber, plants and various non-timber forest products like Ornamentals, gums and resins (Singh, 1999).The traditional healers and old village inhabitants have a sound knowledge related to medicinal uses of plants around them. However, information on the uses of medicinal plants as traditional medicines has not been documented well from various interior areas of Mandi district. The people of these communities, particularly the rural folk and old aged peoples have long been using plants for their various diseases. With the recent development undergoing in this region the people of this region specially the rural folks gained access to modern health care facilities, but still the rural folk at large prefer to stay with their traditional herbal medication due to the easy availability, cost effectiveness and efficacy of the traditional way of healing using medicinal plants (Rao, 1996).

A lot of ethnobotanical work has been done on medicinal plants of District Mandi, but there is negligible work done on the medicinal plants in Chuhar valley region of North Western Himalaya, India. Keeping these factors in view, the present study is carried out with the objective to find out the ethnomedicinal and phytochemical study of Chuhar valley region in North Western Himalaya, India.

LITERATURE REVIEW

The term 'ethnobotany' was first time used in University Archaeological Association, University of Pennsylvania to describe the study of plants used by the people of specific

region (Harshberger, 1896). Hough (1898) has been also defined ethnobotany as study of plant in their relation to human culture. Robbins et al. (1916) defined the term as a study and evaluation of knowledge of all stages of plant life between ancient people and the consequences of the vegetative habitat beyond the life. Jones (1941) defined it as the study of the relationship between plants and humans. Faulks (1958) also explained that ethnobotany is correlation of man of past, present and future with the plant kingdom.

Schutles (I960) had described various examples of ethnobotany among the ancient population. Schutles (1962) also defined the role of ethno botanist in the exploration of important medicinal plants. Jain (1964) communicated on the role of botanist in traditional research. He wrote that folklore study require research on all characteristics of cognitive and material culture of indigenous or primitive people. Uniyal (1968) explained about the therapeutic flora of Bhagirathi valley situated in the forest division of Uttar Kashi. Gupta (1971) also reported about aromatic and medicinal plants of Churah forest division of Chamba district, Himachal Pradesh. Uniyal and Chauhan (1971) described about the medicinal plants of Uhal valley in the Kangra forest division in Himachal Pradesh. Uniyal and Chauhan (1972) also explained about the commercially importance medicinal plants of Kullu forest division in Himachal Pradesh.

Unipal et al. (1973) defined about the introductory examination on therapeutic plants of Lahoul-Spiti division in Himachal Pradesh. Uniyal and Chauhan (1973) also explained about the conventional important medicinal plants of Kangra valley in Dharamshala forest division. Sharma (1976) reported some important wild plants of Himachal Pradesh. Jain and Rao (1977) explained about a manual of field and herbarium techniques. Kapoor (1978) described the survey of the plant wealth of Himachal Pradesh as food source. Chauhan (1984) reported the medicinal wealth of Pabbar valley in Himachal Pradesh. Goel et al. (1984) explained the contribution of the ethno-botany of Santal Paragana. Gogol and Boissya (1984) also presented the information about a few herbal medicines used by the people of Assam (India) against Jaundice.Virjee et al. (1984) performed ethnobotanical study of the primitive areas in district Rajouri, Jammu. Sarin and Chopra (1985) described about the present and future aspects of important aromatic and herbal flora of Himachal Pradesh.

Arora (1987) defined ethnobotany and its function preservation of local plant genetic assets. Chauhan (1988) also explained about the ethnobotanical study of medicinal flora of Himachal Pradesh. Chauhan (1989) surveyed on the medicinal abundance of snowy desert area of Himachal Pradesh. Singh (1990) studied about

important ethnobotanical plants of the Kullu district in North Western Himalaya, India. Negi et al. (1993) worked on the ethnobotanical study of five districts of Garwhal Himalaya, Uttar Pradesh, India. Singh (1993) explained about the herbal plants of Ayurvedic importance from Mandi district of Himachal Pradesh. Gaur and Singh (1993) examined about ethnobotanical plants of Mandi district, Himachal Pradesh. Kapur (1993) also described the ethno medicinal plants of Kangra valley in Himachal Pradesh. Jain and Puri (1994) explained about ethnobotanical survey of medicinal plants of Parvati valley in Himachal Pradesh. Chauhan (1995) surveyed on medicinal flora of Himachal Pradesh useful for economical use. Lal et al. (1996) described about importance of ethnobotany linked with other sectors like anthropology, archeology, forestry, food and nutrition, medicine, art and literature, mythology, defense and survival, sociality, agriculture, economics, language, history, politics, culture, religion and preservation etc.

Henry et al. (1996) reported about important ethnobotanical herbal plants of Southern Western Ghat of India. Saini (1996) described about the medicinal plants used in the beneficial of tribal children and women in the definite areas of Central India. Samwatsar and Diwanji (1996) also studied about the medicinal plants used in snake, scorpion and insect bites. Samwatsar et al. (1996) reported the plants used for various skin diseases, cuts, wounds and bruises by the tribal inhabitants. Katewa and Arora (1997) gave an account on the important herbal plants used in formulation of folk medicine in Udaipur district (Rajasthan). Gill et al. (1997) also described about the traditional medicinal plant applications and beliefs of Bini people in Nigeria. Singh (1999) gave an account on ethnobotanical study of important medicinal plants of Kullu district in north western Himalaya, India. Chauhan (1999) also described about medicinal and aromatic plants of Himachal Pradesh. Sharma and Chauhan (2000) surveyed about the ethno-botanical studies of Gaddi-tribal community of the district Kangra, Himachal Pradesh. Singh and Kumar (2000) also described about the ethnobotanical wisdom of Gaddi tribe in western Himalaya. Samant and Palni (2000) studied about the diversity and traditional uses of essential oil yielding medicinal plants of Indian Himalayan region.

Thakur (2001) defined about the ethnobotany of Rewalsar (District) Mandi (Himachal Pradesh). Sood et al. (2001) also reported ethnobotanical study of herbal flora in cold desert tribes of Lahoul Spiti, north western Hiamalaya. Negi and Bhalla (2002) gave an account about accumulation and promotion of the important medicinal and aromatic plants in the tribal areas of Himachal Pradesh. Negi and Subramani (2002)

described about the ethnobotanical study of medicinal plants in the Chittkul of Sangla valley in district Kinnour of Himachal Pradesh. Sharma (2003) provided the book on knowledge on “Medicinal plants of India”. The potential of medicinal plants as source for new drugs and they possess varied drugs is still largely unexplored. Among the estimated medicinal properties, the different parts used include 250,000-500,000 plant species, only a small percentage has root, stem, flower, fruit, twigs exudates and modified plant been investigated phytochemicals and the fraction organs. Awasthi et al. (2003) also described about the status and distribution *of Jurinea dolmiaea* Boiss. (Dhoop) in different areas has been assessed using stratified random sampling. Tirkey et al. (2003 a) described about the medicinal plants used in the treatment of hair in the Rajgarh district of Madhya Pradesh India. Sharma et al. *(2003)* gave an account on the commercially importance of medicinal and aromatic plants of Parvati Valley (Himachal Pradesh). Sharma et al. (2004) reported the observations on the traditional phytotherapy among the inhbitants of Parvati valley in western Himalaya, India. Sood and Thakur (2004) described about the ethnobotany of Rewalsar Himalaya district Mandi (H.P) India. Warman (2004) also studied the medicinal commercial religions and ornamental properties of various trees of India in "Trees of India". Aggarwal et al. (2004) described about the ethnobotanical studies on some willd plants of lower foot hills of Himachal Pradesh.

Kala (2005) described on the ethno-medicinal botany of the Atapani in the Eastern Himalaya Region of India. Sharma and Lai (2005 studied about the ethnobotanical notes on some medicinal and aromatic plants of Himachal Pradesh India. Sarangi and Sahu (2005) gave an account on the ethno medicinal plants used for venereal and gynecological disorder in Kalahandi, Orrisa Hills. Mahato and Chaudhary (2005) studied about the ethno-medicinal plants of Palpa district of Nepal. Sharma et al. (2005) worked on studies on plants associated indigenous knowledge among the malanis of Kullu district, Himachal Pradesh. Sekar and Srivastava (2005) studied on traditional uses of plants used in curing jaundice in the Pin Valley National Park, Himachal Pradesh. Sharma et al. (2005) worked on ethnobotanical aspects of Malanis and find that total 35 plant species reported here, 16 species are used as general home remedies to treat common ailments like cough and cold, fever, throat and stomach related problems and as a general tonic, 4 plants in bone dislocation or fracture and joints pain, 6 species as veterinary medicine, 4 as insect repellent, 3 for tannins and dyes, 9speciesforsocio-madicoreligiousbeliefs and 5for miscellaneous uses. Uniyal et al. (2006) studied about

the traditional uses of medicinal plants among the tribal communities of Chhota Bhangal. Verma and Chauhan (2006) worked on studies of ethno-medico-botany of Kunihar Forest division, district Solan (H.P). Jadhav (2006), reported the plant sources used for the treatment of different types of fevers by Bhil tribe of Ratlam district, Madhya Pradesh. Dinanath (2007) described about the studies on diversity of medicinal and aromatic plants of Pangi Valley of Chamba district of Himachal Pradesh. Jain et al. (2007) studied unrecorded ethno medical uses of biodiversity from Tad garh-Raoli wildlife sanctuary, Rajasthan, India.

Gautam and Bhadauria (2008) reported a preliminary survey on Ethnomedicinal flora of Bilaspur district. Singh (2008) highlighted the importance of local names of some useful plant in ethnobotanical study. Sharma et al. (2009) studied on some important supplementary food plants and wild edible fugi of upper hilly region of district Shimla (H.P), India. Sharma and Mishra (2009) gave an account on the diversity, utilization pattern and indigenous uses of plants in and around a cement factory in Bilaspur district of Himachal Pradesh, Northwestern Himalaya. Guleria and Vasishth (2009) studied about the ethnobotanical uses of the wild medicinal plants by Gaddi and Gujjars of tribes of Himachal Pradesh. Kharwal and Rawat (2009) described about the ethnobotanical studies on timber resources of Himachal Pradesh (H.P) India. Gautam and Bhadauria (2009) studied ethnobotanical importance of plants from nine villages of Bilaspur district (H.P.) and found that about 23 plant species belonging to 18 families used in the homeopathic system of medicine.

Yadav (2010) reported about 57 medicinal plants species that belonged to 51 genera and 35 families. He found that major emphasis of this community was employed in the treatment of snakebites. Gupta et al. (2010) worked on the antileprotic potential of ethno-medicinal herbs: a review. Gupta (2011) found total of 225 species, belonging to 165 genera and 76 families were collected from the different locations of the Bharmour. Out of total species, the diversity of these medicinal and aromatic plants revealed that there were 60 families belonging to dicotyledons and 6 to monocotyledons. Among dicotyledons, the maximum number of genera belongs to family Asteraceae (15) and Rosaceae (14). Among the dicots, the most represented family was Asteraceae (27 genera and 39 species), whereas, 22 families were found to be having single genus and species each. Verma et al. (2012) described about the ethno medicinal some plants of Kanag Hill in Shimla, Himachal Pradesh; India. Kumar and Choyal (2012) reported the traditional uses of some plants of Hamirpur district of Himachal Pradesh for the

treatment of Jaundice, Hepatitis and other liver disorder. Kumar and Choyal (2012) investigated traditional phytotherapy for Snakebites used by local rural people of Hamirpur district in Himachal Pradesh, India. Sharma et al. (2014) gave an account on studies on traditional knowledge of ethnomedicinal plants in Jawalamukhi, Himachal Pradesh, India. This study reveals traditional medicinal plants belonging to 20 different families of 'Jwalaji Shakti Peeth' which are used for the treatment of various diseases.

Kumar et al. (2015) described study of local plants of Hamirpur district (Himachal Pradesh) which are used traditionally as a source of dye and tannin. Thakur and Sarika (2016) observed that 25 plant species growing in Potters Hill were used as medicines and medicaments in one or the other form. In Una, Chand et al. (2016) reveals that total 159 plant species of 138 genera are used to cure more than 33 types of ailments in Una district of Himachal Pradesh. These medicinal plants were distributed among 68 families. The most important ethno-medicinal plant families were Asteraceae (14 species), Euphorbaceae (10 species), Fabaceae (10 species), Acanthaceae, Ceaselpiniaceae, Moraceae, Solanaceae (6 species each), Anonaceae, Convolvulaceae, Liliaceae (4 species each), only these 10 families accounted about 43.7%plants. Sharma (2016) revealed that 57 plant species are commonly used by local people for curing various diseases. In most of cases Leaf (11spp.), whole plant parts and seed (10 spp.) each, root (6 spp.), flower (4 spp.), flower and leaf (4 spp.), leaf and root(3), rhizome, root and bark, leaf and bark, root leaf and bark, fruit and root, bark fruit leaf (1spp.) each.

Bhardwaj and Seth (2017) worked on the tropical areas of Himachal which include district Una, Hamirpur, Bilaspur and found 135 plant species belonging to 116 genera and 63 families found to be used by inhabitant for remedial purposes. Rana et al. (2017) reveals total 43 medicinal plants were studied in forest of district Una, are very valuable medicinal plants which are already known for their medicinal values. Katoch et al. (2017) study completed in Kangra area tosses light on 130 species of therapeutic plants belonging to 105 genera and 53 families. Out of which 25-30 restorative plants were generally and much ordinarily utilized by nearby tribal individuals for curing close adjoin 30-40 sicknesses differ from straightforward migraine to high fever like illnesses. Chand et al. (2017) found total 85 plant species of 66 genera belonging to 39 families under various life forms and origins were recorded; in which, 30 species as trees (25 native and 5 exotic), 11 shrubs (6 native and 5 exotic), 28 herbs (10 native and 18 exotic) and remaining 16 were creepers (12 native and 4 exotic). Radha et al. (2018) observed that shepherds started their migration in July from Chitkul, Rakchham, Batseri, Sangla

and Kamru of district Kinnaur (Himachal Pradesh). It was observed that in all 50species were used by shepherd's enroot from high hills to low hills. In high hills, 23 species, in mid hills 31 species and in low hills 34 species were found to be used as livelihood source. Kumar and Chander (2018) reveal that fifty four species of fodder plants including trees, shrubs and herbs have been used by peoples of Awah-Devi Region of Hamirpur. Kumar et al. (2019) worked on diversity, distribution and utilization pattern of medicinal plants in Kalatop-Khajjiar Wildlife Sanctuary of Chamba district and recorded 239 medicinal plants (19 trees, 38 shrubs, 173 herbs and 09 ferns) belonging to 185 genera and 85 families. Of the recorded medicinal plants, 101 were natives, 23 near endemic and 01 endemic (i.e., *Scrophularia himalensis* Royle ex Benth.).

Godara et al. (2019) highlighted the ethnomedicinal uses of some plants of Moraceae and Solanaceae family of Hamirpur district of Himachal Pradesh. This paper reveals the use of 16 plant species belonging to two families Solanaceae and Moraceae which are used by rural people as traditional medicines. Kumar et al. (2019) gave an account on the documentation of traditional knowledge about the medicinal value of some wild edible plants resources of Hamirpur district (H.P). Radha et al. (2019) also compiled 41 medicinal plant species belonging to same or different families used by migratory shepherds in Churdhar Wildlife Sanctuary of district Sirmour in Himachal Pradesh. Kumar (2019) reveals different plant species used by the local peoples for different purposes. They revealed 22 species belonging to 4 genera of the family Moraceae have been recorded in district Bilaspur. Out of these 15 species edible, 12 fodder, 8 timbers, 8 medicinal, 5 ornamental and 3 sacred plants. He also revealed total of 103 species of wild edible plants belonging to76 genera and 49 families of district Bilaspur. Kumar and Chander (2019) revealed that 88 plants belonging to 41 families was used by the inhabitants of area of Sikandra Hill range of Mandi districts of Himachal Pradesh for various purposes. Chander and Kumar (2020) documented the some rare ethno-medicinal plants of lower foothills of North-Western Himalaya in Himachal Pradesh. Thakur et al. (2020) found that total of 49 edible plants belonging to 24 families were recorded in the Bharmour of district Chamba. These were commonly used as vegetables, fruits, spices, and chutney. Nearly half of the species belong to Polygonaceae and Rosaceae families. Herbs, shrubs, climbers, and trees form the habit of these plants. The highest proportion of edible species was herbs (29) followed by trees (10), shrubs (8), and climber (1) and *Morchella esculenta*.

RESEARCH GAP IDENTIFICATION

As the study area is one of the treasure house of biodiversity and present close to Wildlife Sanctuary (Nargu). Review of literature shows that few of ethnobotanical work has been done in Nargu wildlife sanctuary area and medicinal plants of District Mandi, but there is no research paper record available regarding inventory of medicinal plant diversity in Chuhar valley region of North Western Himalaya, India as large number of tribal people residing in these villages which make use of local plants for various purposes. So there is need to work more on the following aspects:

- Documentation of different medicinal plants used traditionally by the people of villages in Chuhar valley region of North Western Himalaya, India as research on traditional knowledge is insufficient.
- Conservation and protection of traditional knowledge is lacking so there is need to collect the ethnobotanical knowledge from the local people and analyze it scientifically.
- The scientific information generated will give the first insight in the present status of vegetation, ethnomedicinal uses of the area and help in developing adequate strategies and action plan for the management of the area affected by the developmental activities. Therefore, there is an urgent need to pay adequate attention for the conservation of plant species in this area by supporting ecologically and economically important medicinal species.
- There is a romantic allure to the life of an explorer and the promise of finding 'gold' in the form of plants or animals as potential sources for lifesaving drugs that could become important in the treatment of serious diseases such as Diabetes, Renal failures, AIDS, thyroid and cancer etc.

OBJECTIVES

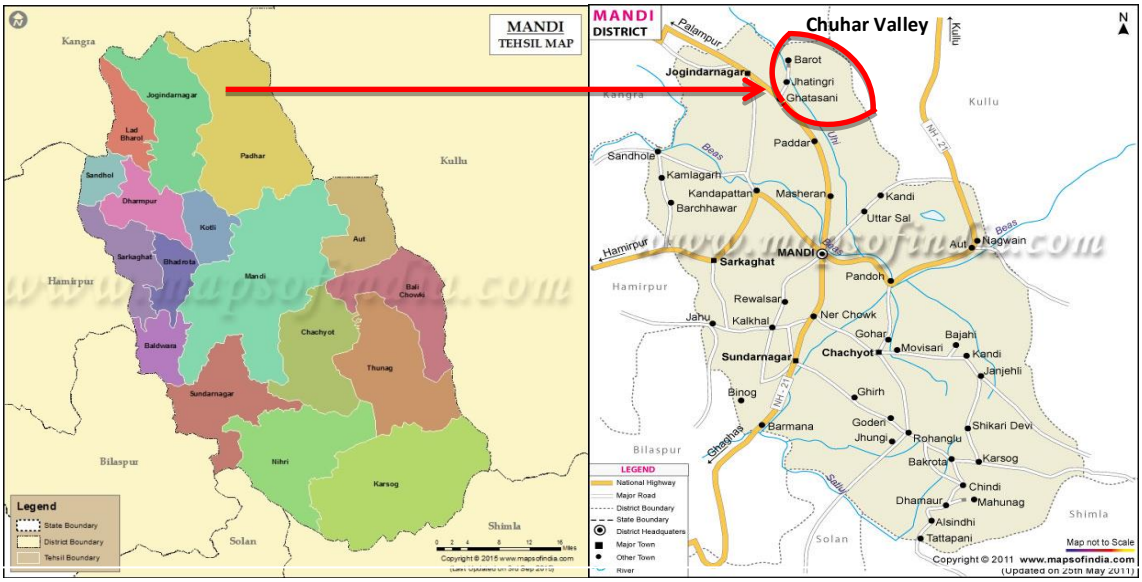
The present work **"Ethnobotany and phytochemistry of medicinal plants of Chuhar valley of Himachal Pradesh, India"** will be carried out with following objectives:

1. To survey, collect, identify and preserve specimens of medicinal plants.
2. To explore ethnomedicinal practices of the local people.
3. To analyze phytochemicals of some selected multi-remedial plants.

PROPOSED METHODOLOGY

Study area

The Present study will be carried out in in Chuhar Valley of Himachal Pradesh, India. This area is located in North part of Mandi district and lies in the catchments of Uhl River. Chuhar valley is surrounded on both sides by parts of the Dhauladhar range of the Himalayas and lies between 32°2'11″ North Latitude; 76°50'51″East Longitude and the altitude varies from 1850-2850 metres (fig. 1). Most of the forest around valley is deodar and Himalayan oak. Barot town in Chuhar valley is also developing into an angling destination. The Uhl River supports trout breeding and Barot has a few fish farms. Across the river Uhl is the Nargu Wildlife Sanctuary, home to goral, Himalayan black bear and a variety of pheasants. In the International festival of Mandi Shivratri, three major deities from this valley come to meet the theocratic king of Mandi, Lord Radha Madhav. There are many low and high passes that connect Mandi to Kullu in the Chuhar valley. The major attractions in and around Chuhar valley are Jhatingri, Barot, Hurang Narayan temple, Nagru wildlife sanctuary, the haulage trolley, Dev Pashakot/Barot temple and Shanan power house etc. Chuhar valley is surrounded by thick forests which are home to black bear and monal. Dev Pashakot is believed to be the King of the Valley and even today people believe in his justice system. The green fields and snow clad mountains will take you to the dream land.



Source: https://www.mapsofindia.com

Fig.1. Map of Study area showing Chuhar Valley Region of District Mandi, Himachal Pradesh, India

Field survey

The frequent field survey will be carried out in the different months of the year in Chuhar valley region of district Mandi, Himachal Pradesh, India. The plants used by the folk peoples for treatment of various diseases will be documented by using structured questionnaire, interviews and discussions among the folk people (above 18 years). Following questionnaire will be used for recording the information (Jain 1995):

Informant Details

Name:	Sex:	Age:
Village:	Panchayat :	District:
Main occupation:	Contact Number:	
Subsidiary occupation	Education:	

Ethnomedicinal uses of plants

(1) Local/vernacular name of plant:

(2) Scientific name of plant:

(3) Part of plant used:

(4) Name of ailment/other purposes in which plant part is used:

(5) Mode of preparation:

(6) Use (externally/internally):

(7) Availability in natural habitat:

(8) Cause of declining of ethnomedicinal plants if any (overgrazing, encroachments, forest fire, mining activities, climatic change and others):

(9) Who knows best about plant and uses: vaid, shepherds, old people/new generation, and others:

(10) Any ethnomedicinal plant species under cultivation:

(11) Any awareness camps /trainings /exposure visits organized for ethnomedicinal plants:

(12) Any conservation practices on ethnomedicinal plants:

A group of local people will be taken to the field and specimen of ethnomedicinally important plants will be collected along with photographs in their natural habitats. The collected specimens will be dried and pressed in plant presser for 12 to 14 hours. Individual specimen within blotters will be kept between corrugated sheets. The collected plant species will be dried and preserved by making herbarium (Jain and Rao, 1967).

Plant identification will be done with the help of Taxonomists from Career Point University Hamirpur, Himachal Pradesh Biodiversity Board Shimla, FRI Dehradun, HFRI Shimla, Himachal Pradesh University, Agriculture University Palampur, and Dr.Y.S. Parmar University Solan as well as flora of British India and flora's of FRI and BSI Dehradun. Prior to carrying out the survey, discussion about the study will be undertaken with the District Forest officer, Mandi, Himachal Pradesh. Additionally, in each village the local community leaders will be inform about the objective and purpose of the survey and requested to cooperate. Each informant will ask to consent verbally to take part in the study so as to follow the ISE (International Society of Ethnobiology) code of ethics.

Ethnobotanical studies

The importance of collected plants regarding the traditional knowledge, local use of the plants of the study area, containing the information about the local name of the plants, part used, purpose for which used, mode of administration and curative properties will be recorded through discussion with the knowledgeable and elderly local people of the area. Depending upon the ethnobotanical information so obtained the plants will be enlisted along with their traditional uses. The trend in the earlier time was to utilize medicines plants as such in their crude, fresh juice, paste, boiled extract or dried powder but with the advancement of civilization, they will be more acceptable in easily ingestible forms such as decorations, herbal tea, tablets, syrups, tinctures, steam distillates etc., which gradually entered into medical practice.

Data analysis

For data analysis the use of MS excel spread sheet on a computer and would be presented in frequency tables, bar-graphs, and a pie chart. Facilities in MS excel spreadsheet will be utilized to make simple calculation, determining proportions and Informant consensus factor (ICF) values.

Informant Consensus Factor (Fic)

The informant consensus factor (F_{ic}) will be calculated towards checking, there is an agreement in the use of plants in the illness categories among the plant users in the study area. The F_{ic} will be calculated by the following formula (Heinrich et al., 1998).

$$F_{ic}=N_{ur}-N_t/(N_{ur}-1)$$

Where N_{ur}denotes to the number of use-reports for a specific disease group and N_t refers to the quantity of plant species used for a particular disease group by all informants. The product of this factor ranges from 0 to 1. A high value (close to 1.0) indicates that relatively few plants are used by numerous the informants. The least value illustrated that the informants disagree on the taxa to be used in the treatment within a category of illness.

Use value (UV)

The relative significance of each plants species known locally to be used as herbal remedy is shown as the use value (UV) and it will be calculated by using the following formula (Phillips et al., 1994).

$$UV=\Sigma U/ n$$

Where UV is the use value of a species, U is the number of use information mentioned by each informant for a given plant species and n is the total number of informants questioned for a given plant. The UV is helpful in finding the plants with the maximum use (most frequently indicated) in the treatment of a disease. UVs are high when there are numerous use-reports for a plant and low when there are a few reports associated to its use.

Fidelity level (FL)

To find out the most commonly used plant species for treating a particular disease group by the informants of the study; we will calculate the fidelity level (FL).The FL will be calculated using the following formula (Friedmen et al., 1986).

$$FL\ (\%) =N_p/N \times 100$$

Where N_p is the number of use- reports cited for a given species for a particular ailment category and N is the total number of use reports cited for any given species. Generally, high FLs are obtained for plants for which almost all use-reports refer to the same way of using it, whereas low FLs are obtained for plants that are used for many purposes (Srithi et al., 2009).

Preparation of plant extract

Plants are complex matrices, producing a range of secondary metabolites with different functional groups and polarities. Although water is used as an extractant in many traditional protocols. Organic solvents of varying polarities are generally selected in modern methods of extraction to exploit the various solubilities of plant constituents. Soxhlet extraction is widely used for both initial and bulk extraction. Its main advantage is that the material is extracted continuously, i.e., the solvent saturated in solubilized metabolites empties into the flask, fresh re-condensed solvent then re-extracts the material in the thimble. This method is less time and solvent consuming than maceration or percolation.

100g of ground weighed material of fine coarse powder will be successively extracted by different solvents of hexane, chloroform and methanol, in a specific sequence based on increasing polarity. The Soxhlet hot extraction procedure for each of the above solvents will be run for about 6 hours, until a colorless solvent will be seen in the siphon tube, which indicates complete extraction. The solvents will be removed under reduced pressure and controlled temperature by rotary evaporator. The extracts will be dried and stored in a clean glass bottle and will be kept at 4-6°C for further phytochemical screening.

Phytochemical Analysis

The phytochemical test of these extracts will be performed using the methodadopted by Harborne (1973), Sofowora (1993) and Adigew (2022):

1. Test for Carbohydrates (Molisch‘s Test): To 2ml of plant extract, 1ml of Molisch‘s reagent and a few drops of concentrated sulfuric acid will be added. The presence of purple or reddish color indicates the presence of carbohydrates.
2. Test for Tannins (Ferric Chloride Test): To 1ml of plant extract, 2ml of 5% ferric chloride will be added. Formation of dark blue or greenish black indicates the presence of tannins.
3. Test for Saponins (Frothe‘s Test): To 2ml of plant extract, 2ml of distilled water will be added and shaken in a graduated cylinder for 15 minutes lengthwise. Formation of 1 cm layer of foam indicates the presence of saponins.
4. Test for Flavonoids (Shinoda Test): To 2ml of plant extract, 1ml of 2N sodium hydroxide will be added. Presence of yellow color indicates the presence of flavonoids.

5. Test for Alkaloids (Mayer‘s Test): To 2ml of plant extract, 2ml of concentrated hydrochloric acid will be added. Then a few drops of Mayer‘s reagent will be added. The presence of green color or white precipitate indicates the presence of alkaloids.
6. Test for Glycosides (Molisch‘s Test): To 2ml of plant extract, 3ml of chloroform and 10% ammonia solution will be added. Formation of pink color indicates presence of glycosides.
7. Test for Quinones: To 1ml of extract, 1ml of concentrated sulfuric acid will be added. Formation of red color indicates presence of Quinones.
8. Test for Terpenoids (Salkowski Test): To 0.5ml of extract, 2ml of chloroform will be added and concentrated sulfuric acid will also added carefully. Formation of red brown color at the interface indicates presence of terpenoids.
9. Test for Phenols (Ferric Chloride Test): To 1ml of the extract, 2ml of distilled water followed by a few drops of 10% ferric chloride will be added. Formation of blue or green color indicates presence of phenols.
10. Test for Proteins: To the 0.5ml of extract, 2ml of 40% sodium hydroxide and 1ml 1% $CuSO_4$ will be added, formation of pink colour indicates presence of proteins.

Thesis Outline

Chapter1	**Introduction**	This chapter contains background about the research area.
Chapter2	**Literature Review, Research Gap Identification and Objectives.**	In this chapter a detailed review of literature which highlights the previous research works and methodologies used by different workers will be discussed. This chapter contains different points related to research gap on the basis of which topic with specific objectives can be decided.

Chapter3	**Proposed Methodology**	This chapter provides the details of all the methodologies used to carry out in present research.
Chapter4	**Results and Discussion**	In this chapter results of present research work will be shown and discussed.
Chapter5	**Summary and Conclusions**	In this chapter conclusion drawn from the findings will be discussed.
Chapter6	**References**	Harvard referencing system.

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CERTIFICATE
(SYNOPSIS APPROVAL CERTIFICATE)

This is to certify that the Synopsis for Ph.D. Thesis titled, **"ETHNOBOTANY AND PHYTOCHEMISTRY OF MEDICINAL PLANTS OF CHUHAR VALLEY OF HIMACHAL PRADESH, INDIA"**, submitted by **Ms. Ashima Mahajan** to the Career Point University, Hamirpur (H.P.), India in partial fulfillment of the requirements for the degree of **DOCTOR OF PHILOSOPHY** in the Division-Botany, Department of Biosciences, School of **Basic and Applied Sciences** has been approved by the Research Advisory Committee (RAC) after an Oral Examination of the student on dated 12-12-2022

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